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MASS GIS NEWSLETTER

Massachusetts Geographic Information System

Number 5, Spring 1989

Initial Phase of Open Space Datalayer Completed

The final floppy disk of protected open space data was delivered from UMASS School of Landscape Architecture and Regional Planning (LARP) to the MassGIS project on February 7. A statewide map displaying this data was plotted on February 14.

These milestones represent the completion of Phase I of the protected open space data development project undertaken by the Dept. of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE) and EOEA with the cooperation of DEM, MDC, DEQE, and DFA. Currently, only parcels of open space protected by state, federal and large private non-profit organizations have been mapped and digitized. The programs protect land ranging from state wildlife management areas to agricultural preservation restrictions to federal land encompassing the Appalachian Trail.

The Phase I database comprises over 2000 parcels of land that cover over 500,000 acres. Given that the size of Massachusetts is 5,179,500 acres, about 10% of the Commonwealth has been protected by the agencies whose parcels are mapped. Much protected land is not represented in the Phase I database, however.

The remaining lands are planned to be mapped and digitized in Phase II of the protected open space data development project which is currently underway. The majority of these lands have been preserved by the 351 cities and towns comprising the Commonwealth. Additional lands are owned by the Army Corps of Engineers flood control program and some of the smaller private non-profit organizations. Any phase I lands that were overlooked will also be added to the database.

Several projects are currently underway in Phase II. They illustrate the importance of this data to the achievement of a comprehensive inventory of protected open space in Massachusetts.

The Essex County Greenbelt Association compiled open space maps of Essex county that included community owned open space. All Phase I & II parcels have been digitized. It was found that 200 parcels (46% of the total) and 10,000 acres (48% of the total) of protected open space were owned and managed by communities.

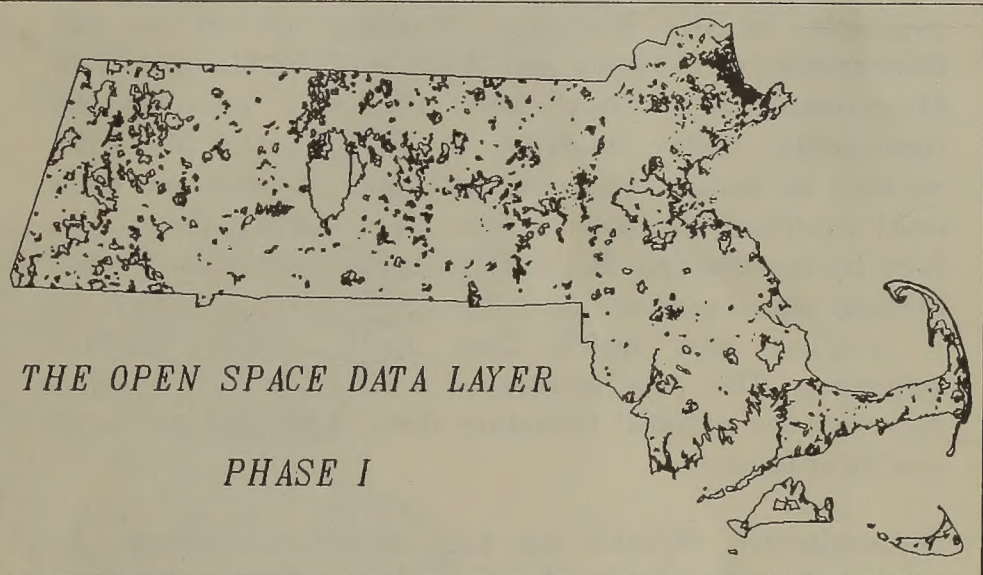
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EOEA To Install ARC/INFO

The Executive Office of Environmental Affairs Data Center Modernization project has progressed rapidly in the past five months. Final plans and procurements have been drawn. A new DEC VAX and Banyan file-server based computer network will be installed in June.

ARC/INFO and ORACLE will be installed on the VAX 6330 during the end of June. EOEA is also purchasing five PC ARC/INFO workstations; two will be housed at EOEA, one at Coastal Zone Management's Marion office, one at the Dept. of Fisheries, Wildlife & Environmental Law Enforcement, and one at DEQE Div. of Wetlands and Waterways.

Once the VAX environment is stabilized and ARC/INFO installed MassGIS will begin porting the database from the USGS Prime computer. Completion of the transfer and the initiation of EOEA training are planned for the end of August.



Massachusetts Restarts State Map Advisory Committee

The federal government, is the principle producer of medium scale mapping in Massachusetts and the United States. The USGS, as the lead cartographic agency in the federal government, is required by the Office of Management and Budget to factor the requirements of each state into the planning of its annual mapping program.

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Updating a Datalayer

The MassGIS project began distributing the political boundaries data layer (MA25K) in the spring of 1987. The coverage contains the community boundaries of the 351 cities and towns in Massachusetts. It was digitized from stable based 1:25,000 USGS quadrangle sheets. Extensive revisions have been made since that first release. The process of updating this data illustrates the importance of continual data updates as well as some of the problems involved in distributing digital data.

MA25K was the first large scale data input project that MassGIS undertook. The data was assembled by the following steps:

- 1) David Weaver, the MassGIS cartographer, digitized the political boundaries from 189 separate, scale stable, USGS topographic quadrangles.
- 2) The 189 separate pieces of digital data were then edgematched and appended into a single coverage.
- 3) The coastline was extracted from the USGS DLG 1:100,000 scale hydrography data and integrated to the political boundary coverage. Topology was created.
- 4) All polygons were identified with their community code #. An attribute database was assembled that included TOWN-NAME, POPULATION in 1980, COUNTY-CODE, and the AREA.

This effort was completed in March of 1987. By August of 1987 MassGIS began distributing MA25K to other organizations producing GIS data. The data was made available to the Resource Mapping Group at the Department of Forestry and Wildlife of the University of Massachusetts. They were digitizing land-use by community under contract to EOEA and MassGIS wanted to insure that the community boundaries they used matched the ones in the MassGIS database. In fact, by distributing MA25K, MassGIS was able to have UMass use the community boundaries from MA25K as a *template* into which they could digitize landuse polygons. This process insured a very accurate overlay between the political boundary data layer and the land-use data layer.

Subsequently, MA25K has been distributed widely. In part due to the large utilization of this datalayer, errors have come to the attention of MassGIS. MassGIS undertook the following several steps to improve MA25k:

- 1) All errors were noted and corrected when appropriate. Errors ranged from poor edgematching, to missed lines on peninsulas to errors in the attribute coding.

- 2) All islands had a label placed in them and were identified in the attribute data as belonging to the correct town. This enhancement, for example, allows users to easily create a complete map of individual coastal communities, or an accurate counties map.

- 3) An attribute was added to the *line* attribute table (the .AAT, as opposed to the polygon attribute table, the .PAT) that identified lines which made up the outline of the state (the .AAT item is called OUTLINE). This allows users who are creating a map to use a dashed line for community boundaries while using a solid line for the coast and state boundary.

- 4) The MassGIS cartographer added an annotation layer to the data. This places the community name within the boundary of the town and alters the size and angle of the letters depending on the polygon shape. This annotation is stored in 'scaled units' and thus its size changes automatically depending on the output scale that the user selects.

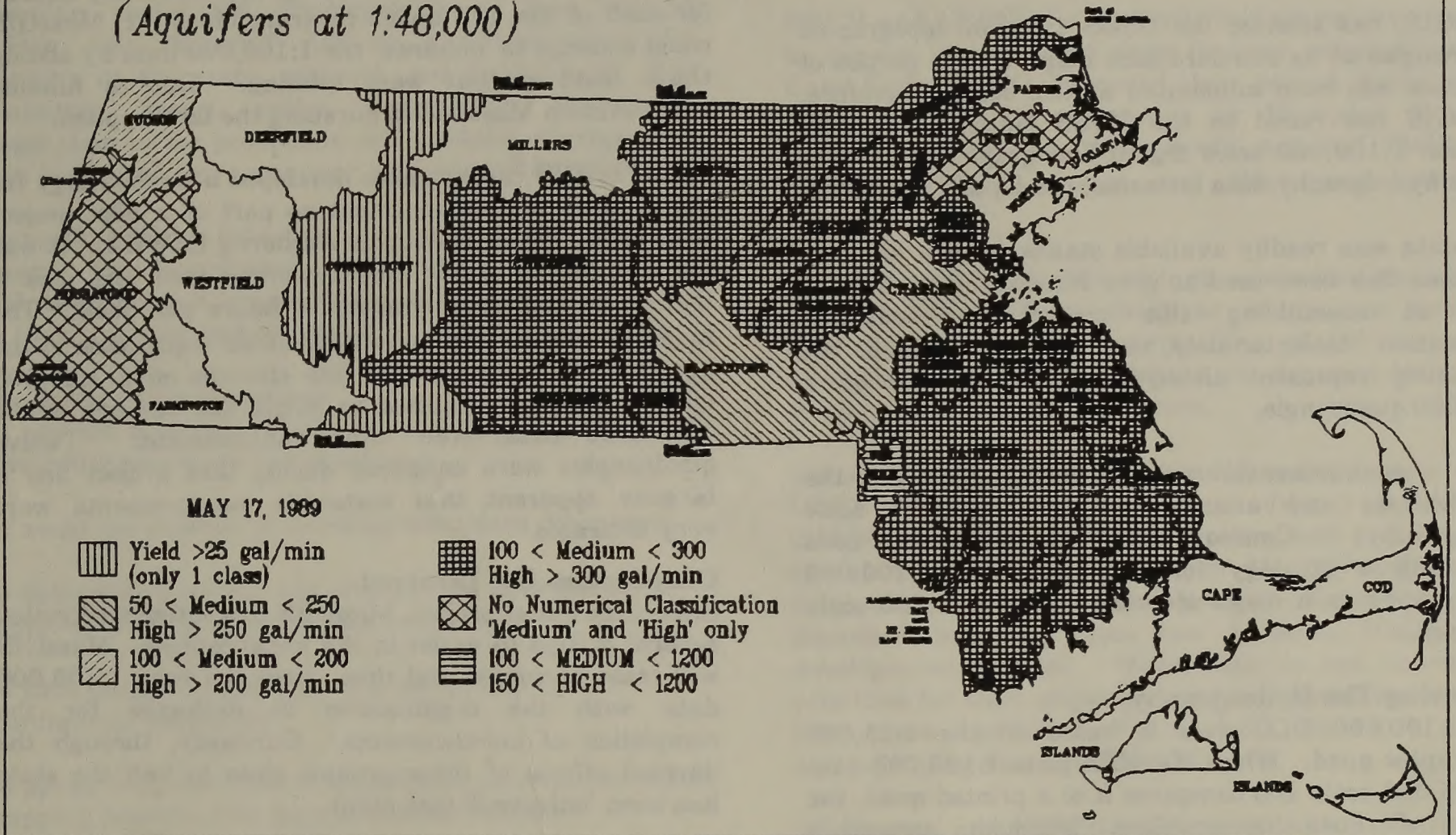
Currently, the political boundary data layer resides in the MassGIS database under the name TOWNS. As MassGIS distributes additional data only updated copies are distributed. This has obvious implications on those who already have a copy of MA25K. Where were the errors? Can I get a new copy of the improved data?

This also has implications on the MassGIS staff. Whose responsibility is it to inform users of errors? How can we physically distribute the improved data to the dozens of organizations that have received copies of it? These are difficult questions. Tremendous resources could be spent managing the distribution of data updates and due to the small size of the MassGIS staff this could cause the growth of the database to suffer.

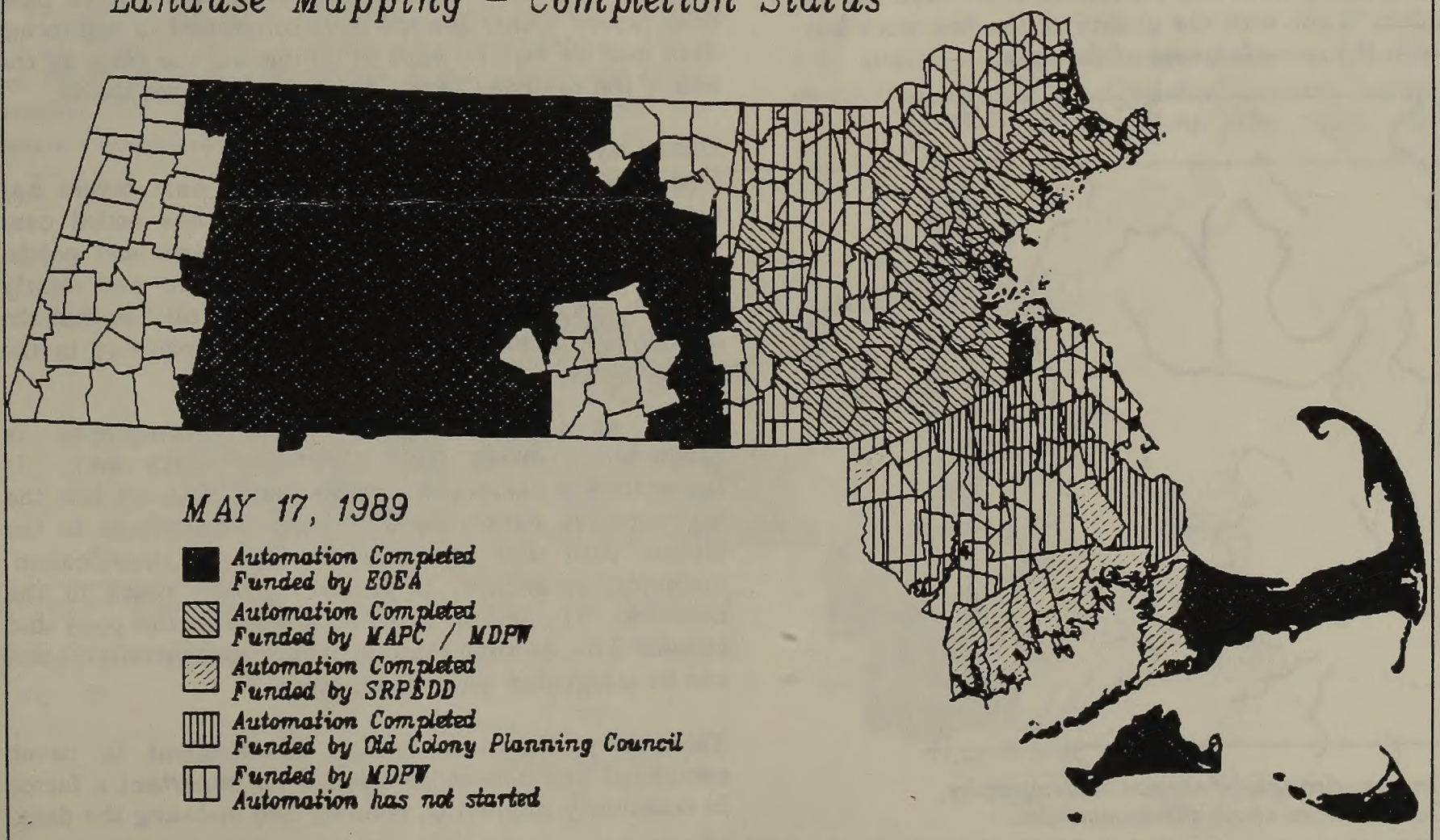
The following is the MassGIS interim policy for distributing updated data. 1) MassGIS will always distribute the most up-to-date version of any data layer. The date of the most recent revision is attached to the coverage in the Documentation file. 2) MassGIS will periodically print in this newsletter, or distribute by mail, a description of alterations to the data. This will inform users of changes and enhancements to the database. 3) Users can request updated data. The request will be treated as a *new* request and thus it will be subject to any cost recovery mechanism that may be in place.

Data updates are critical and a GIS database must be considered continually dynamic. While it is up to MassGIS to keep EOEA's data current, it is up to users to keep their *own* databases up-to-date.

Hydrologic Atlas Digitizing Completion Status (Aquifers at 1:48,000)



UMASS Resource Mapping Group Landuse Mapping - Completion Status



Cooperative Efforts Help Get Hydrography Enhancements Underway

MassGIS, has selected the USGS 1:25,000 topographic quadrangles as its standard base map. Only a portion of the state has been automated at this scale. Therefore, MassGIS has relied on the USGS National Mapping Division 1:100,000 scale digital line graph (DLG) data for its hydrography data (streams, ponds, and coastline).

This data was readily available statewide at a low cost and thus has been used to give Massachusetts a head start at assembling this critical and complex information. Unfortunately, the 1:100,000 DLGs do not adequately represent all hydrographic features on a 1:25,000 quadrangle.

Many environmental applications require the completeness and accuracy of the 1:25,000 scale hydrography. Consequently, MassGIS has been developing a strategy for improving the 1:100,000 hydrography as a major step towards a 1:25,000 scale basemap.

Improving The Hydrography

The 1:100,000 DLG data is based on the 1:25,000 topographic quad. When MassGIS plots 1:100,000 data at 1:25,000 scale and compares it to a printed quad, the match of lines is excellent although somewhat generalized in the 1:100,000 DLG's. The major difference is that some of the minor streams or ponds are missing from the DLG's. MassGIS estimates that on the average quad 40% of the smaller stream features and 20% of the pond features that exist on a 1:25,000 quad are missing from the 1:100,000 DLG data. Thus the problem is not with the quality of the line work but rather is in the *completeness* of the data.



*One quadrangle of stream hydrography.
Dashed lines show enhancements.*

MassGIS has several options for improving the data. 1) The state could jointly fund with USGS the digitizing of the 1:25,000 quads (as Connecticut and New Hampshire did). The cost of a state match is approximately \$1,000 for each of the 189 quads covering Mass. 2) MassGIS could attempt to 'enhance' the 1:100,000 data by adding those features that were missing. Due to funding consideration MassGIS is pursuing the latter option.

The MassGIS cartographer developed a methodology for performing this enhancement as part of a pilot project with Mass. Water Resources Authority (MWRA). It was found that the enhancement worked well and took a trained person approximately 4 hours per quad. The major shortcoming of enhancement vs. digitization of the quads is that some double line streams on a 1:25,000 quad will remain depicted as single line streams in the 1:100,000 data even after enhancement. Twelve quadrangles were enhanced during that project and it became apparent that statewide enhancements were very desirable.

Cooperators Get Involved

Since that initial project, MassGIS has actively recruited several groups to assist in the enhancement. MassGIS will train personnel and then share the base 1:100,000 data with the organization in exchange for the completion of enhancements. Currently, through the devoted efforts of these groups, close to half the state has been 'enhanced' (see map).

MassGIS would like to extend special thanks to Anita Beinikis at DEQE Division of Water Supply (Berkshire County), Beth Flynn at IEP Inc. (Blackstone River Basin), Tom Farmer and Bill Wandle from USGS-WRD (several areas), and Sue Sherman (Southeastern Mass.) for their excellent work in improving this critical base data layer. Other groups have committed to enhancing data and we look forward to completing the state by the end of the calendar year. Any volunteers out there?

Other Hydrography Enhancements

One other major enhancement to the data layers has also been completed. David Weaver has added over 6,000 pieces of annotation to the streams and ponds. These names are placed to follow streams and clearly identify ponds. They are stored in 'scale units' so that the size of the annotation automatically is adjusted to the output scale of a map.

Much work also remains before hydrography is complete. Among the outstanding tasks are: 1) Integrating a comprehensive wetlands data set into the hydrographic network. 2) Adding an attribute to the stream data that identifies the 'stream classification' (primary, secondary, tributary) of each reach in the network. 3) Adding a coding scheme to the pond and stream data so that existing water quality information can be integrated with the graphics.

This story shows how data development is never completed and how cooperation is an important factor in constantly improving, refining and updating the data.

Massachusetts Forms Geographic Information Committee

The Senate Special Committee on Long Range Policy Planning, under the Chairmanship of Sen. William Golden, has identified GIS as a strategic tool for planning at the state, regional, and local levels. The committee report make clear that interagency cooperation in the production and analysis of geographic data is a regulatory, economic, and scientific necessity.

Responding to this initiative, a number of Massachusetts agencies have organized a working committee to deal with the profound impact this new technology is having on their agencies and programs.

The **goals** of the group are:

- to provide a forum for the sharing of knowledge about developing programs and databases
- to avoid the expense of creating redundant databases
- to determine methods and protocols for distributing digital data to all levels of government
- to save money on software and equipment by coordinating purchases
- to speak with one voice to the federal government about mapping projects that impact Massachusetts.

The group has met 5 times since November 1988. Recent meetings have had over 45 in attendance, including representatives from the Executive Office of Environmental Affairs, E. O. Communities & Development, Dept. Capitol Planning & Operations, E. O. Transportation & Construction, Mass Dept. of Public Works, Univ of Mass., regional planning agencies, Cape Cod Planning, Arlington, Salem State College, the Mass Institute for Social & Economic Research, and the Senate Committee.

A number of these agencies have made presentations to the group about their ongoing projects and plans: EOE reviewed the MassGIS project and the implementation of their in-house GIS system.

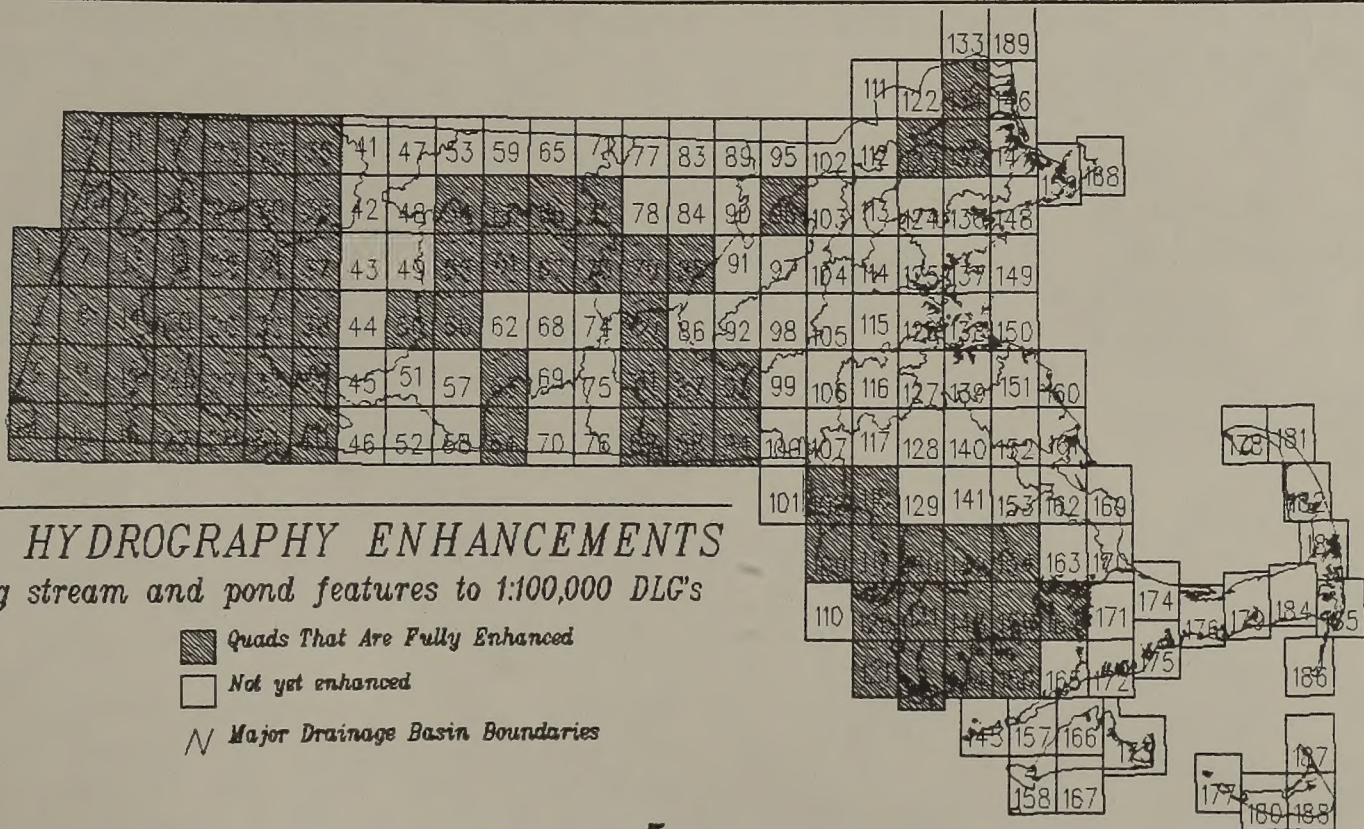
EOCD and CCPEDC presented their cooperative project to develop parcel-based data for two communities on Cape Cod. DCPO discussed their project to automate and study DCPO properties in Hampden County. MDPW reported on their newly acquired McDonald Douglass CADD system and their road attribute database.

The planning director for Arlington described its detailed parcel-based attribute database which has been in production for several years. The project is a fine example of systematic attribute development being put in place before GIS procurement.

Outside groups have also attended our meetings. The USGS coordinator of state map advisory committees (SMACs) came to our March meeting and presented an overview of USGS activities in Massachusetts. He emphasised USGS's commitment to digital data and discussed how the state can influence USGS data development projects. Massachusetts can submit its priorities for their ongoing mapping projects and can co-fund new projects of mutual interest. (See accompanying story on SMACs.)

US Census and MISER staff presented an overview of the TIGER database, which is beginning to be released nationwide. Its geographic basemap is closely related to the DLG basemap that MassGIS has been fine-tuning. The TIGER attributes are extensive, and the release of Massachusetts files will greatly enhance the MassGIS attribute database.

All interested agencies are welcome to the GIS committee meetings. Contact Prudence Lange (727-9800) for information about the next meeting.



Open Space *Continued*

o The Dept. of Fisheries, Wildlife and Environmental Law Enforcement hired an intern to compile the protected open space managed by communities for the Nashua River basin. These manuscripts are currently being digitized by UMASS LARP. DFWELE plans on using this data to support open space acquisitions based on a drainage basin approach.

o In Berkshire County, Warren Archy of UMASS Extension Program is orchestrating the compilation of the community controlled open space. Many citizen volunteers are helping with this task.

o The EOEa Dept. of Conservation Services is adopting GIS as a tool in its ongoing community open space grants program. Currently on a 5 year cycle, up to 80 communities per year could be providing digitizable Phase II open space maps to EOEa.

EOEA is extremely interested in gathering and digitizing community owned open space. The logistics of gathering this data from the 351 communities is problematic given current staffing levels. Consequently, EOEa needs help. If such information has been compiled in hard copy, EOEa will find a means of automating it. If any community, regional planning agency or other group possesses or is willing to develop USGS 1:25,000 topographic quadrangles with community owned open space parcels drafted onto them, please contact the MassGIS project. We can provide guidelines for compiling the open space onto 1:25,000 quadrangles. We will also find a way to automate the data.

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Map Advisory Committees *Continued*

The USGS has a number of mapping programs ongoing in Massachusetts, including the 1:25,000 quad series, and water resource mapping. In addition to the familiar paper maps, they have a strong commitment to digital data, including planimetric and topographic information..

The USGS encourages states to organize state map advisory committees (SMACs) as a way of consolidating and transmitting mapping priorities to the federal government. Most states have active SMACs. Massachusetts has not had such a group in more than a decade.

Because of the digital revolution in cartography, there is increased interest in mapping by many agencies in Massachusetts. A SMAC is being formed as a part of the state geographic information committee. For more information, contact the MassGIS Office

Staff Notes

The MassGIS project was sorry to see original team members, Beth Flynn and Julio Olimpio leave the USGS last winter. Beth was the GIS project chief, and is now managing GIS operations for a private consultant. Julio was GIS supervisor, and has started up the northeast ESRI office... And a big hello to new MassGIS staff, Peter Steeves and Steve Predmore!

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